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ABSTRACT

"Quest into Matter," produced by Ontario (Canada) Instructional Television, aimed to investigate the "heart of matter" at the college freshman level of chemistry. Specifically, its purpose was to demonstrate the relevance of "shape" in relation to the properties of matter from the molecular level to the galactic. Some 180 students enrolled in a first year chemistry course, and 17 freshman chemistry teachers took part in the evaluation of the program which involved responding to a set of questions after viewing the program. The students found the programs stimulating, informative, and neither boring or confusing. Most found the analogies in the program very or somewhat helpful in understanding the various properties of matter and very or somewhat relevant to their chemistry course. Teachers responded even more favorably than students. Over 90 percent found the program somewhat to very stimulating and neither boring nor confusing. Most teachers also found it very informative. Like the students, the teachers found the analogies very or somewhat helpful in understanding the various properties of matter and very or somewhat relevant to a first year chemistry course. They also preferred a combination of both the method used in the program and a conventional lecture-type method and stated they would like to see more programs of this type used in their classes. The findings suggest that programs like "Quest into Matter" would be readily welcomed as supplementary material to textbook information. (Author/HB)

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QUEST INTO MATTER

FINAL REPORT

Project Research NO. 1975 - 7

December

QUEST INTO MATTER

FINAL REPORT

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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The Ontario Educational
Communications Authority

Research and
Planning Division

Abstract
Quest Into Matter

By Olga Kuplowska

"Quest into Matter" is a program investigating the "heart of matter", aimed primarily at grade 13/first year university chemistry students. Specifically, its purpose is to reveal the relevance of "shape" in relation to the properties of matter from the molecular level to the galactic.

One hundred and eighty university students enrolled in a first year university chemistry course and 17 grade XIII chemistry teachers took part in the evaluation of this program which involved responding to a set of questions after viewing the program.

Overall, the students found "Quest into Matter" stimulating (72.6%), informative (74.2%), and neither boring (86.2%) nor confusing (94.6%). Eighty-five per cent found the analogies in the program very or somewhat helpful in understanding the various properties of matter and almost three-fourths (74.9%) of the student sample found the program to be very or somewhat relevant to their chemistry course. When asked which method of presentation they preferred, the one used in the program or a conventional lecture-type method, 80.4% indicated a preference for a combination of both and 92.0% said they would like to see more programs of this type used in their science classes.

A cross-tabulation by the students' area of study revealed no apparent significant differences between the areas although both natural science and nursing students tended to have the highest percentages of positive responses. However, because of the very small numbers of biological and physical science students, these comparisons are to be interpreted carefully.

The teachers responded even more favourably than the students. Over 90% found the program somewhat-to-very stimulating and neither boring nor confusing. Seventy-nine per cent found it somewhat-to-very informative. Like the students, the teachers found the analogies very or somewhat helpful (88.2%) in understanding the various properties of matter and 85.7% felt that the program was very or somewhat relevant to a first year chemistry course. They also preferred a combination of both the method used in the program and a conventional lecture-type method (80.0%) and 88.2% stated they would like to see more programs of this type used in their classes.

These findings suggest that programs like "Quest into Matter" would be readily welcomed as supplementary material to textbook information.

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QUEST INTO MATTER

"Quest into Matter" is a program investigating the "heart of matter", aimed primarily at grade 13/first year university chemistry students. Specifically, its purpose is to reveal the relevance of "shape" in relation to the properties of matter from the molecular level to the galactic.

Purpose of Study

The main objectives of this evaluation were:

1. to test the reaction of the target audience to the program; and
2. to provide some indication as to the general usefulness of this type of approach to teaching science.

Sample Description

One hundred and eighty university students enrolled in a first year university chemistry course and 17 grade XIII chemistry teachers took part in the evaluation. They were selected because the program was aimed primarily at people involved with chemistry at that level and because they were readily available.

Table 1 presents the breakdown of students by their reported major area of study. More than half the students were enrolled in the sciences, about one-fourth were in nursing, and the rest were enrolled in other faculties. Although the overall male/female distribution was quite closely balanced (Males = 51%; Females = 46%), Table 1 shows

TABLE 1

Student Sample Distribution,
By
Area of Study and by Sex

Area of Study	The Number of Students		Males		Females	
	N	%	N	%	N	%
Sciences	105	58.3	72	68.6	28	26.6*
(Natural Sciences)	(51)					
(General Sciences)	(34)					
(Biological Sciences)	(10)					
(Physical Sciences)	(10)					
Nursing	38	21.1	0	-	38	100.0
Miscellaneous	29	16.1	16	55.2	13	44.8
Not Stated	8	4.4	4	50.0	4	50.0
Total	180	99.9	92	51.1	83	46.1

* Five science students did not state their sex.

TABLE 2

Distribution of Teachers,
By
Sex

Sex	N	%
Male	10	58.8
Female	1	5.9
Not Stated	6	35.3
Total	17	100.0

that nursing accounts for most of the females: less than 1/3 of the science students were females.

All students were taking at least one chemistry course. Only one reported taking five such courses and two did not respond to that question.

None of the teachers were enrolled in chemistry courses at the time of the evaluation, but they all taught chemistry at the secondary level. Because there was only one reported female among the teacher sample (see Table 2), all tabulations for the teachers will be based on the total group number.

Methodology

"Quest into Matter" was screened before the students during regular classtime and the questionnaire (Appendix A) was administered after the screening by the class professor.

The teachers who participated were enrolled in a course at the University and viewed the program during one of their classes.

Findings

A. Student Sample

Overall, the students found "Quest into Matter" stimulating (72.6%), informative (74.2%), and neither boring (86.2%) nor confusing (94.6%) (Table 3).

When cross-tabulated by the students' area of study (Tables 4, 5, 6, 7), no significant differences among the responses seem to be apparent

TABLE 3

Degree to which Student Respondents found "Quest into Matter" stimulating, informative, boring and confusing.

Adjectives Describing Film	Very and Somewhat	Uncertain	Not Very or Not at all	N
Stimulating	72.6	23.2	4.2	168*
Informative	74.2	19.9	5.8	171*
Boring	4.2	9.6	86.2	167*
Confusing	1.2	4.2	94.6	166*

* The total N varies due to no response by some of the respondents to some of the respondents to some of the questions.

TABLE 4

Degree to which Student Respondents found "Quest into Matter" stimulating, by Area of Study.

Area of Study	Degree Stimulating				
	Very	Somewhat	Uncertain	Not Very or Not At All	N
Science	25.0	49.0	23.0	3.0	100
(Natural)	(26.0)	(50.0)	(24.0)	(0.0)	(50)
(General)	(25.0)	(46.9)	(21.9)	(6.3)	(32)
(Biological)	(22.2)	(55.6)	(22.2)	(0.0)	(9)**
(Physical)	(22.2)	(44.4)	(22.2)	(11.1)	(9)**
Nursing	26.5	47.1	23.5	2.9	34
Miscellaneous	25.9	48.1	14.8	11.1	27
Not Stated	-- *	--	--	--	7
Total	26.2	46.4	23.2	4.2	168

* In this and subsequent tables, percentages are computed wherever the N is 8 or more.

** Percentages for biological and physical sciences are to be interpreted with care because of relatively small N's.

TABLE 5

Degree to which Student Respondents found "Quest into Matter" informative, by Area of Study.

Area of Study	Degree Informative				
	Very	Somewhat	Uncertain	Not Very or Not At All	N
Sciences	22.8	52.5	19.8	4.9	101
(Natural)	(27.5)	(54.9)	(15.7)	(2.0)	(51)
(General)	(18.8)	(53.1)	(18.8)	(9.4)	(32)
(Biological)	(20.0)	(50.0)	(20.0)	(10.0)	(10)
(Physical)	(12.5)	(37.5)	(50.0)	(0.0)	(8)
Nursing	42.9	37.1	17.1	2.9	35
Miscellaneous	32.1	35.7	17.9	14.3	28
Not Stated	--	--	--	--	7
Total	29.2	45.0	19.9	5.8	171

TABLE 6

Degree to which Student Respondents found "Quest into Matter" boring, by Area of Study

Area of Study	Very or Somewhat	Degree Boring: Uncertain	Not Very	Not at all	N
Sciences	3.1	11.3	24.7	60.8	97
(Natural)	(0.0)	(10.3)	(24.0)	(66.0)	(50)
(General)	(6.7)	(13.3)	(36.7)	(43.3)	(30)
(Biological)	(11.1)	(0.0)	(11.1)	(77.8)	(9)
(Physical)	(0.0)	(25.0)	(0.0)	(75.0)	(8)
Nursing	0.0	8.6	28.6	62.9	35
Miscellaneous	14.3	3.6	25.0	57.1	28
Not Stated	--	--	--	--	7
Total	4.2	9.6	25.1	61.1	167

TABLE 7

Degree to which Student Respondents found "Quest into Matter" confusing, by Area of Study.

Area of Study	Degree Confusing				
	Very or Somewhat	Uncertain	Not Very	Not at all	N
Sciences	1.0	3.1	26.5	69.4	98
(Natural)	(0.0)	(4.0)	(28.0)	(68.0)	(50)
(General)	(0.0)	(3.2)	(25.8)	(71.0)	(31)
(Biological)	(0.0)	(0.0)	(22.2)	(77.8)	(9)
(Physical)	(12.5)	(0.0)	(25.0)	(62.5)	(8)
Nursing	2.9	0.0	17.6	79.4	34
Miscellaneous	0.0	11.1	14.8	74.1	27
Not Stated	--	--	--	--	7
Total	1.2	4.2	23.5	71.1	166

although both natural science and nursing students tend to have the highest percentages of positive responses in all four categories. However, because of the very small numbers of biological and physical science students in the sample, these and subsequent comparisons between the areas of study should be regarded with care.

Eighty-five per cent found the analogies in the program very or somewhat helpful in understanding the various properties of matter. The frequencies by area of study are presented in Table 8. It is interesting to note that for this question also, science students again had the lowest percentage of positive responses, relative to the others.

Slightly more variance is found among the groups' perceptions of the degree of relevancy of "Quest into Matter" to their chemistry course. Although overall, almost three-fourths (74.9%) of the student sample found the program to be very or somewhat relevant, only 58.8% of general science students and 60.0% of physical science students found it relevant (Table 9). These percentages, while still a majority, are lower than those of students in the other sciences or in nursing. Furthermore, even those students whose major area of study was not in the sciences, found the program more relevant to their chemistry course than these two groups. No further explanation of these differences can be offered at this time because of the unequal representations in each area of study and because only basic data was collected.

When asked which method of presentation they preferred, the one used in the program or a conventional lecture-type method, 80.4% indicated

TABLE 8

Degree to which Student Respondents found analogies in "Quest into Matter" helpful, by Area of Study.

Area of Study	Degree Helpful				N
	Very	Somewhat	Uncertain	Not Very or Not At All	
Sciences	32.4	53.3	10.5	3.8	105
(Natural)	(39.2)	(47.1)	(11.8)	(2.0)	(51)
(General)	(23.5)	(61.8)	(11.8)	(2.9)	(34)
(Biological)	(50.0)	(50.0)	(0.0)	(0.0)	(10)
(Physical)	(10.0)	(60.0)	(10.0)	(20.0)	(10)
Nursing	34.2	55.3	5.3	5.2	38
Miscellaneous	41.4	41.4	13.8	3.4	29
Not Stated	37.5	37.5	0.0	25.0	8
Total	34.4	51.1	9.4	5.0	180

TABLE 9

Degree to which Student Respondents found "Quest into Matter" relevant to their chemistry course, by Area of Study.

Area of Study	Degree Relevant				
	Very	Somewhat	Uncertain	Not Very or Not At All	N
Sciences	20.0	51.4	18.1	10.5	105
(Natural)	(21.6)	(60.8)	(13.7)	(3.9)	(51)
(General)	(17.6)	(41.2)	(23.5)	(17.6)	(34)
(Biological)	(10.0)	(60.0)	(20.0)	(10.0)	(10)
(Physical)	(30.0)	(30.0)	(20.0)	(20.0)	(10)
Nursing	15.8	71.1	13.2	0.0	38
Miscellaneous	7.1	64.3	17.9	10.7	28
Not Stated	37.5	37.5	12.5	12.5	8
Total	17.9	57.0	16.8	8.4	179

a preference for a combination of both and 92.0% said they would like to see more programs of this type used in their science classes. This suggests that films like "Quest into Matter" would be readily welcomed as supplementary material to text book information. The frequency breakdowns for these responses are presented in Tables 10 and 11.

B. Teacher Sample

Even more favourable responses were given by the teachers. Over 90% found "Quest into Matter" somewhat-to-very stimulating and neither boring nor confusing. Seventy-nine per cent found it somewhat-to-very informative (Table 12). Like the students, they found the analogies very or somewhat helpful (88.2%) in understanding the various properties of matter (Table 13).

They too preferred a combination of both the method used in the program and a conventional lecture-type method (80.0%) and 88.2% stated they would like to see more programs of this type used in their classes (Tables 14, 15).

Although the teachers were not enrolled in a chemistry course, 85.7% felt that "Quest into Matter" was very or somewhat relevant to a first year chemistry course. Only 2 were undecided (Table 16).

Resumé

On the basis of the above findings, it appears that the program "Quest into Matter" was very well received by both students and science teachers, and especially by natural science and nursing students who tended to report slightly higher percentages of positive responses for most questions. Our data indicate that similar programs would be welcomed by both students and teachers to supplement existing materials.

TABLE 10

Expressed Preference of Student Respondents for Various Presentation Methods, by Area of Study.

Area of Study	Methods				N
	Presentation Method used in Film	Lecture-Type Method	Combination of Both Methods	Other	
Sciences	11.4	4.8	80.0	3.8	105
(Natural)	(7.8)	(3.9)	(84.3)	(3.9)	(51)
(General)	(11.8)	(5.9)	(76.5)	(5.9)	(34)
(Biological)	(20.0)	(0.0)	(80.0)	(0.0)	(10)
(Physical)	(20.0)	(10.0)	(70.0)	(0.0)	(10)
Nursing	18.4	0.0	81.6	0.0	38
Miscellaneous	14.3	3.6	82.1	0.0	28
Not Stated	25.0	0.0	75.0	0.0	8
Total	14.0	3.4	80.4	2.2	179

TABLE 11

Expressed Desire of Student Respondents for more programs like "Quest into Matter", by Area of Study.

Area of Study	Expressed Desire			N
	Yes	No	No Response	
Sciences	90.3	7.8	1.9	103
(Natural)	(96.1)	(2.0)	(2.0)	(51)
(General)	(84.8)	(12.1)	(3.0)	(33)
(Biological)	(100.0	(0.0)	(0.0)	(10)
(Physical)	(66.7)	(33.7)	(0.0)	(9)
Nursing	97.3	2.7	0.0	37
Miscellaneous	89.3	10.7	0.0	28
Not Stated	100.0	0.0	0.0	[illegible]
Total	92.0	6.8	1.1	176

TABLE 12

Degree to which Teacher Respondents found "Quest Into Matter" stimulating, informative, boring and confusing.

Adjectives Describing Film	Degree			N
	Very and Somewhat	Uncertain	Not Very & Not At All	
Stimulating	93.8	0.0	6.3	16*
Informative	80.0	20.0	0.0	15*
Boring	0.0	6.7	93.3	15*
Confusing	7.1	0.0	92.8	14*

* The total N varies due to no response by some respondents to some questions.

TABLE 13

Degree to which Teacher Respondents found analogies helpful in "Quest into Matter".

Degree	%
Very Helpful	64.7
Somewhat Helpful	23.5
Uncertain	5.9
Not Very Helpful	5.9
Not At All	0.0
N	17

TABLE 14

Expressed Preference of Teacher Respondents for Various Presentation Methods

Methods	%
Presentation Method used in film	20.0
Lecture-Type Method	0.0
Combination of Both Methods	80.0
Other	0.0
N	15

TABLE 15

Expressed Desire of Teacher Respondents for more programs like "Quest into Matter".

Degree	%
Yes	88.2
No	11.8
N	17

TABLE 16

Degree to which Teacher Respondents found "Quest into Matter" relevant to their science classes.

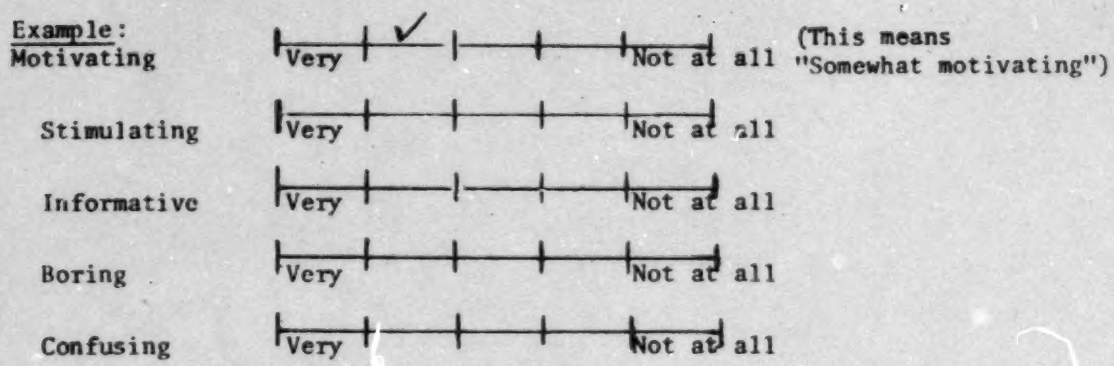
Degree	%
Very Relevant	50.0
Somewhat Relevant	35.7
Uncertain	14.3
Not Very Relevant	0.0
Not At All	0.0
N	14

EVALUATION OF "QUEST INTO MATTER"

The program you have just watched is the first of three programs which introduces you to a fundamental aspect of chemistry. The purpose of this program is to reveal the relevance of "shape" in relation to the properties of matter from the molecular level to the galactic. In order to evaluate the acceptability of the program among viewers, we would like to have your reactions.

Please answer each of the following questions and return the completed questionnaire to Dr. Blizzard's or Dr. Humphrey's office.

1. This program could be described by the four words listed below. Would you indicate to what extent you feel "Quest into Matter" was stimulating, informative, boring, and confusing? Please check (✓) for each.



2. "Quest into Matter" made frequent use of analogies between the structure of matter and man's environment (e.g., virus cell and lunar module, molecular bonds and hand in glove.) To what degree did these analogies help you understand the various properties of matter?

( ) Very helpful
( ) Somewhat helpful
( ) Undecided
( ) Not very helpful
( ) Not at all helpful

Please complete the reverse side...

3. This program intends to present how the being of man is linked with the structure of all matter. The method used in this program to show how science is related to nature and man differs from the conventional lecture-type method where laboratory demonstrations and equations are given. Which of the following methods do you prefer? If more than one, please number your preferences from 1 to 4.

( ) The presentation method used in this program.
( ) The conventional lecture-type method.
( ) A combination of both methods.
( ) Other (specify): _____

_____

4. How relevant would you say this program is to the content of this course, Chemistry 1A7?

( ) Very relevant
( ) Somewhat relevant
( ) Undecided
( ) Not very relevant
( ) Not at all relevant

5. Would you like to see more programs of this type used in your science classes?

( ) Yes
( ) No

6. Please complete the following items:

Area of study: _____

How many chemistry courses are you taking this year? _____

Female ____

Male _____

THANK YOU FOR YOUR CO-OPERATION.